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European Integration, FDI and the Geography of French Trade*

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Abstract

This paper uses an augmented gravity model to investigate whether the 1978-2000 process of European integration has changed the geography of trade within France, with a particular focus on the trends experienced by border regions. We support the conclusion that, once controlled for bilateral distance, origin- and destination-specific characteristics, French border regions trade on average 72% more with nearby countries than predicted by the gravity norm. They perform even better (114%) if they have good cross-border transport connections to the neighboring country. However, this outperformance eroded drastically for the French border regions located at the periphery of Europe throughout integration. We show that this trend is partly due to a decreasing propensity of foreign affiliates to trade with their home country. This trade reorientation is less pronounced for the Belgian-Luxembourgian and German firms located in the regions which have better access to the EU core.

JEL classification: F15, F23, R12, R58.

Keywords: Trade, Gravity, Border regions, European Integration, Foreign Direct Investment.

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1 Introduction

The recent wave of European eastward enlargement came along with an increasing fear of outsourcing to the new entrants. This makes prominent the question of how European integration is likely to affect the geography of economic activities. As the empirical evidence focused overwhelmingly on the post-integration re-allocation effects *between* old and new member *countries*, this paper aims to extend the assessment to the context of *regions within* countries. A particular focus is put on whether the border regions located at the interface of integrating countries expanded or suffered consequently to their shift from a peripheral position within France to a central location within the common market. Our approach is also innovative in that it considers foreign direct investment and cross-border transport infrastructure as possible channels conveying regional trade differentials. Economic integration, by improving market accessibility and alleviating impediments to both trade and multinational activity, induces multinational firms to invest in the new regional bloc. Since foreign affiliates are more likely to locate according to "market potentials", as recently emphasized by Head and Mayer (2004), the border regions located at the core of rich Europe might benefit from the over-representation of outside firms and, if FDI and trade are complementary activities, from trade expansion. As for policy prospects, the question of whether border regions exhibit specific attractiveness for economic activities is of eminent significance in the context of the adoption by the European Commission of multiple entrepreneurship, trade and transport cross-border programmes under the new cohesion policy 2007-2013. To facilitate cross-border cooperation, the EU has indeed recently created a new legal entity, the European Grouping for Territorial Cooperation (EGTC) enabling to group the authorities of various member states, without the need of prior international agreements.

The issue of whether economic integration might favor or hamper border regions is controversial. From a theoretical point of view, the New Economic Geography (henceforth NEG) has sought to extend the usual 2-country (or 2-region) setting to frameworks in which both inter- and intra-national inequalities are assessed. In a model with a foreign country and a home country, each composed of two equidistant domestic regions (the core and the periphery), Krugman and Livas (1996) show that trade liberalization between countries favors the regional dispersion of increasing return to scale activities between the core and the periphery of each country. Hence, the peripheral region could reap from the magnification of urban congestion within the core. However this result is not robust: when the dispersion force materializes into immobile workers, instead of urban congestion, catastrophic agglomeration may occur, as shown by Monfort and Nicolini (2000) and Paluzie (2001). In a slightly modified setting, in which one of the two domestic regions is farther away from the foreign market than the other, Crozet and Koenig (2004) show that trade liberalization drives domestic firms to the region closer to the border, unless competition pressure from the foreign market is too fierce. As opening up to trade with a foreign economy increases exports (foreign demand) and imports (foreign supply), the impact of trade liberalization is the result of two counteracting forces: increased market access (favorable to export production) and increased import competition (negative for domestic producers that compete with foreign supply).

Nonetheless, the core-periphery models of the Krugman's type are not only known for the extreme result that trade costs reduction would yield catastrophic agglomeration, but also for their analytical intractability. Hence, recent studies have tried both to attenuate centripetal forces and to provide analytical solutions to the models. For instance, Brülhart *et al.* (2004) build a 3-region setting in which the manufacturing sector uses mobile human capital as the fixed cost and immobile workers as the variable cost of production. They find that, for most parameter configurations, trade liberalization favors the concentration of human capital in the border region. However, this mechanism is not deterministic: A sufficiently strong pre-liberalization concentration of economic activity in the interior region can make this concentration globally stable, and predicts even more agglomeration in this region. Behrens *et al.* (in press) develop a 2-country 4-region model in which low inter-country trade costs is shown to promote regional dispersion when inter-regional trade costs are high enough. Behrens *et al.* (2006) use the same model to investigate the role of "gate" regions, through which goods are shipped to the international market. If one country is endowed with such a region, the latter benefits from agglomeration when the country is well integrated whereas, in the other case, it is the landlocked region. Therefore, theory has not reached a consensus on whether or not border regions might benefit from integration processes. Hence, empirical analysis is even more crucial to identify the main mechanisms at work.

The main empirical approach consists in testing the NEG predictions of backward (demand) linkage effects:[1] the better a region's access to large markets, the higher its factor prices, output, or a mix of the two. Therefore, regional wage gradients, which were initially decreasing monotonously from center to periphery, might possibly reverse consequently to changes in trade regimes and market potentials. As for output variables, adjustments are driven by the number of firms, and regions with good access to foreign markets end up with a higher share of activities. Regarding North-America, Hanson (1996a, 1996b, 1997, 2001) are among the pioneer empirical studies assessing whether the NAFTA process entailed changes in wages or employment within participating countries. While they provide strong evidence of jobs relocation by the two sides of the U.S.-Mexico border following NAFTA, they do not yet support unequivocally the wage gradients reversal prediction. EU prospects concern

[1] See Niebuhr and Stiller (2004) for a comprehensive survey.

mostly the recent eastward enlargement and the fear that, as the borders of CEE countries become internal to the EU, economic activities could shift towards Eastern border locations, eventually at the expense of Western border regions. For instance, Brülhart and Koenig (2006) compare the wage gradients of five accession countries (Czech Republic, Hungary, Poland, Slovenia and Slovakia) to those of incumbent EU countries, for the period 1996-2000. They find that concentration in the capital regions is significantly stronger in the former and that nominal wages are higher in the border regions of incumbent EU countries. Hence, they conjecture that market forces would likely favor Eastern border regions. Based on simulated changes in the market accessibility of EU27 regions, Niebuhr (2005) also supports the conjecture that border regions could experience above-average integration benefits due to their favorable access to foreign markets. A noticeable exception to the eastward focus is the recent work by Overman and Winters (2003, 2005), who examine whether the UK's accession to the EEC in 1973 impacted the location of domestic manufacturing activities within the UK. Accession is shown to have a mitigated effect: even though manufacturing activities might have relocated south-eastwards, several industries also retreated north-westwards, because of increased import competition. Therefore, the empirical estimation of backward linkages, both in the factor price version (wages) and quantity version (employment or production) indicates that regions bordering the largest and richest markets do seem to benefit from economic integration with them. By contrast, the results for regions bordering poorer markets are more mixed. Some of them, like the South of the US, experience positive effects while for others, particularly in Eastern Europe, the impact might be negative.

Our empirical approach is different in that first, we focus on the western part of Europe and secondly, we concentrate on trade rather than on wage and employment issues. Post-integration changes in trade performances that would depend on where regions are located within countries have been rarely investigated. Two noticeable exceptions have to be mentioned. First, Coughlin and Wall (2003) distill the trade impact of NAFTA on the US states. Their conclusion is that, following NAFTA, 28 (36, respectively) U.S. states experienced a rise of more than 10% in their exports towards Mexico (Canada, respectively), while 8 (4, respectively) were negatively affected. However, the core-periphery nature of winners and losers is not assessed. In contrast, Egger and Pfaffermayr (2002) analyze the trade impact of the 1960-1998 process of EU integration, with a special focus on trade within and between the core and periphery countries. They find out that, while both core-periphery and intra-periphery countries benefited more from EU integration than intra-core countries, this positive effect reduced throughout the enlargement. The southern enlargement even turned to exert a negative effect on the intra-core volume of trade.

In line with Egger and Pfaffermayr (2002), we assess the trade differentials sparked by European integration, but we focus on the case of French regions. We develop an augmented gravity model in which European integration is materialized through the reduction of FDI barriers. We then quantify the trade performance of border regions as their deviation from the value of trade predicted by this gravity norm. We find evidence that, everything else equal, French border regions trade on average 72% more with nearby countries than predicted by the norm, and even more (114%) if they have good cross-border transport connections. However, the process of European integration has coincided with a large decrease in this trade overperformance over the period 1978-2000. This trend was driven by the drastic fall in the deviations experienced by the most peripheral French border regions within the EU. Neither the Single European Act nor the completion of the Single Market were sufficient to counterbalance the decline. We find that these trade differentials can partly be attributed to FDI regional patterns, and more precisely to a decreasing scope for trading with the home country. However, this trend is less pronounced for the Belgian-Luxembourgian and German firms located at the vicinity of the EU core.

The remainder of the paper proceeds as follows. Section 2 provides some stylized evidence on the suitability of the gravity framework for the study of the interplay between trade performances and FDI. Section 3 describes the augmented gravity model, as well as the data and methodological issues. Section 4 provides two sets of results for France. The first set relates to the 1978-2000 long-span evolution of trade differentials between border and interior regions, whereas the second set analyzes more specifically the role of inward FDI in the period 1993-2000. Section 5 concludes.

2 Trade and FDI patterns of French regions: Stylized evidence

A detailed assessment on whether integration is likely to affect the internal geography of trade requires a thorough theoretical and econometric analysis, that we will seek to provide in subsequent sections. However, if border regions experience specific trends arising from the counteracting forces described in the Introduction, we should be able to pick up them with the naked eye. Section 2 therefore provides a set of stylized facts on the trade and FDI patterns of French regions.

2.1 Trade specialization patterns by country

To illustrate that proximity is a clear catalyst for trade, a brief look at the relative trade performances of regions inside France is instructive.[2] So as to assess the relative specialization of regions across partner countries, we compute the following trade index. Let J denote the trade partner country of

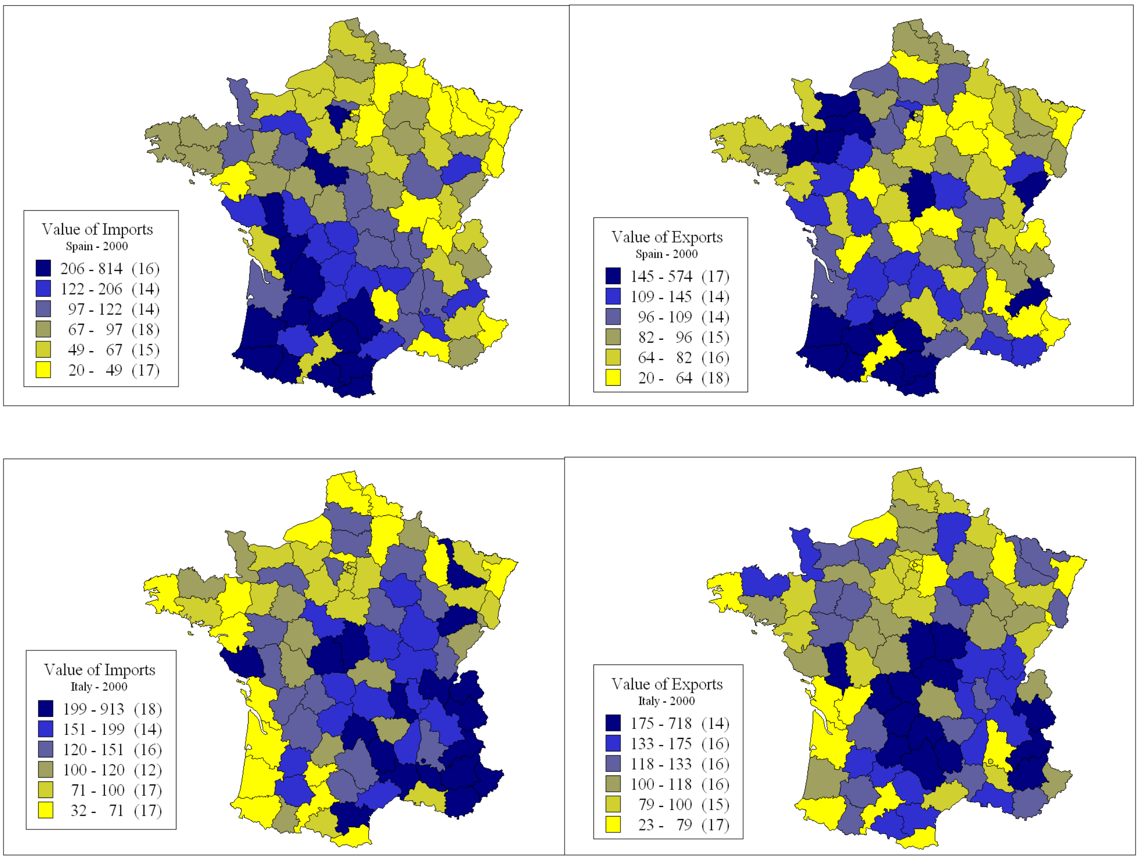
[2] As we seek for trade differentials depending on whether regions border a country or not, we examine only the six EU countries neighboring France: Belgium, Luxembourg, Germany, United-Kingdom, Spain and Italy. Due to data constraints, we treat Belgium and Luxembourg as a single partner country for French regions. Appendix A presents the data sources.

region i. We define $s_{iJ} = F_{iJ}/\sum_{i\in I} F_{iJ}$ as the share of region i in the country I's trade with country J, and $x_i = \sum_K F_{iK}/\sum_{i\in I}\sum_K F_{iK}$ as its share in the country I's international trade. The simplest way to measure how much the trade of region i is oriented towards the partner country J, and to compare this trade intensity across countries, is to compute the following Balassa Trade Specialization Index:

$$TSI_{iJ} = \frac{s_{iJ}}{x_i} \times 100. \tag{1}$$

Values above 100 mean that region i trades relatively more with country J than would be predicted by its share in international trade. Figures 1 and 2 exhibit the patterns obtained in 2000.

Figure 1: Trade specialization of French regions with respect to: Spain (top) and Italy (bottom)



Source: Authors' computations based on data from the SITRAM database (French Ministry of Transport). See Appendix A for further details.

The gravity pattern of trade is striking: regardless of the direction of trade, border regions always outperform "vis-à-vis" the countries with which they share a frontier. This pattern is especially clear at the French borders with Belgium-Luxembourg and Germany. For instance, with a TSI of respectively 280 for exports and 355 for imports, the French NUTS3 "Ardennes", which borders Belgium, is almost four times more export-oriented towards this country than with the rest of the world.

Hence, proximity gives the agents located on both sides of the same frontier clear incentives to trade. Sometimes however, specific border regions have a surprisingly low TSI. For instance, in the NUTS3 region of "Haute-Garonne", which hosts Toulouse and has a border with Spain, mountains in the central part of the Pyrenees represent a major geographic obstacle and make cross-border transport particularly difficult. Therefore, a strict contiguity criterion is not always sufficient to embody the real border nature of regions, as the geography of frontiers may also deeply affect trade specializations.

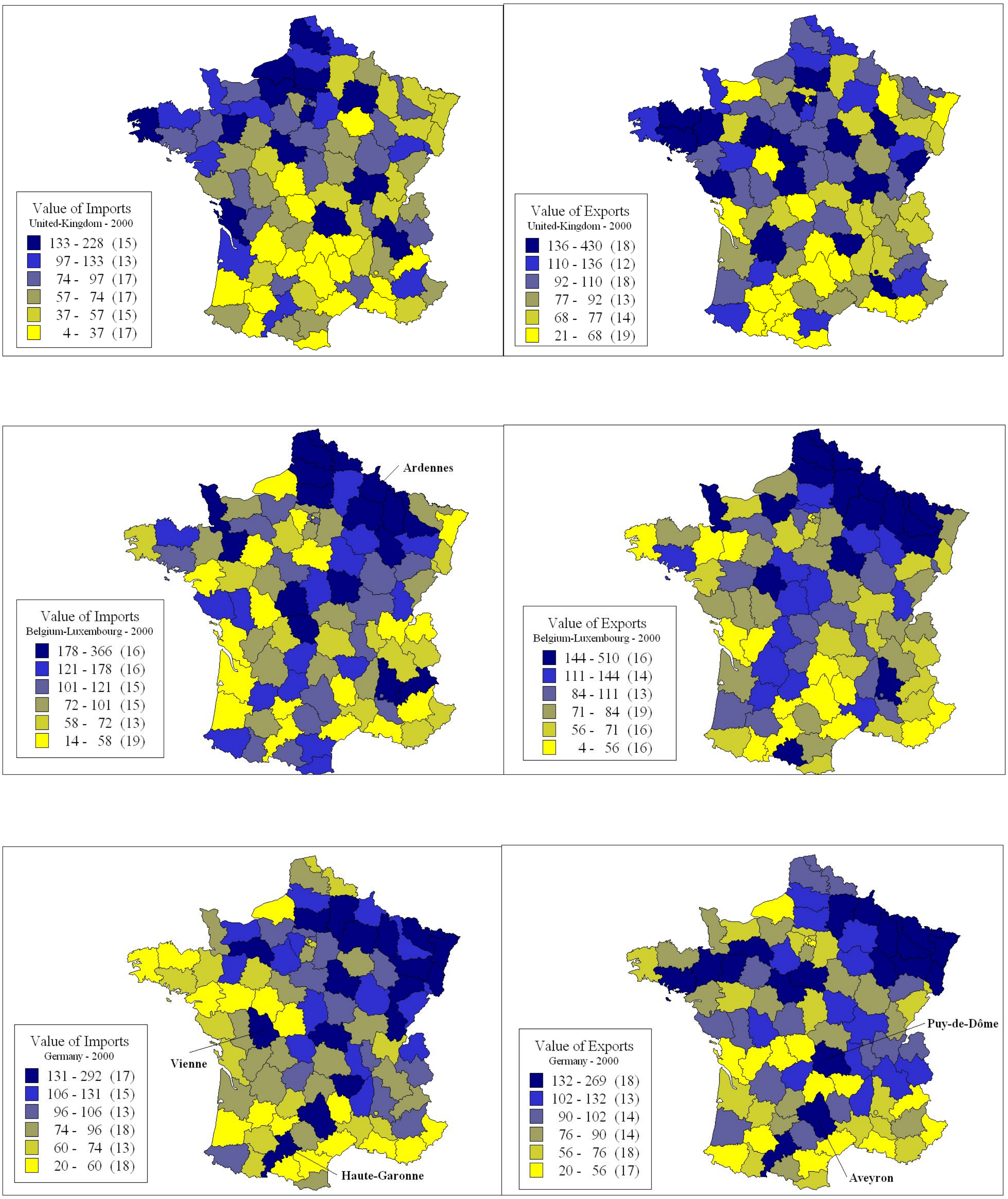
Furthermore, interior regions sometimes present surprisingly high levels of specialization with regard to a partner country, in spite of being located very far away. One first plausible explanation is that cross-border input-output linkages might generate specific patterns which are not necessarily of the gravity type. For instance, the French central regions of "Puy de Dôme" and "Vienne" exhibit a strong specialization of exports oriented towards Germany, probably due to the presence of the French firm Michelin, which produces equipment goods for German firms such as BMW, Daimler-Chrysler and Volkswagen A.G. A second explanation is that vertical outsourcing, which enables foreign investors to benefit from advantages other than reduced transport costs (such as low taxes, rents or wages) might also cause extreme specialization patterns. Foreign inward direct investment from neighboring countries is likely to boost trade due to input-output linkages between the foreign parent firm in the home country and its affiliates in the host region. For instance, the south region of "Haute-Garonne" comes out as the most specialized regarding exports to Germany, although it is located on the opposite side of this country. The reason may be that it hosts the European Aeronautic Defence and Space (EADS) consortium, of which the German firm Daimler-Chrysler owns more than 30%. Therefore, to compare the trade performance and orientation of regions we have to bear in mind that FDI might expand the trade of interior as well as of border regions. Next section focuses more specifically on this issue.

2.2 FDI specialization patterns by country

Figure 3 depicts the inward stocks of Foreign inward Direct Investment based on four different variables: Number of foreign affiliates, created or saved related employment (hence, zero indicates greenfield investment), and millions of euros invested.[3]

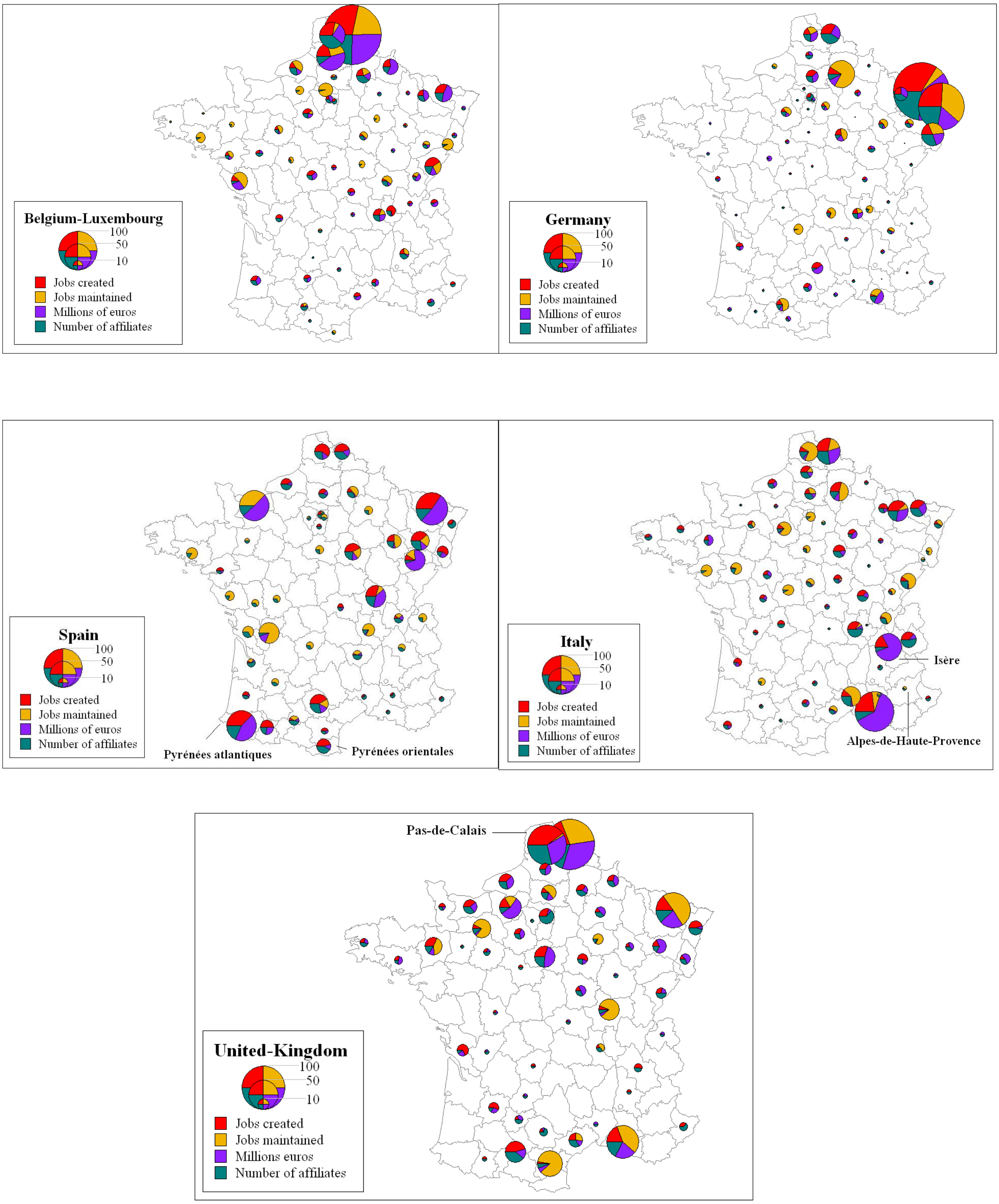
[3] Appendix A presents the data sources.

Figure 2: Trade specialization of French regions with respect to: United-Kingdom (top), Belgium-Luxembourg (middle) and Germany (bottom)



Source: Authors' computations based on data from the SITRAM database (French Ministry of Transport). See Appendix A for further details.

Figure 3: Regional stocks of FDI by country source in 2000 (in % of total FDI from the country)



Source: Authors' computations based on data from the French Government Agency for International Investment (AFII). FDI flows (productive activities only) cumulated over 1993-2000. See Appendix A for further details.

Two striking features arise from this picture. First, regardless of their nationality, foreign firms have a clear preference for the regions located along the north-eastern frontier of France. These border regions present conducive conditions for investment as they benefit from good access to the richest internal French regions, due to the high density of highway infrastructures towards the French capital,[4] and also to the core of Europe. As the propensity to invest increases with market potentials (Head and Mayer, 2004), the north-eastern French border represents a good trade-off between the desire to save on accessing French consumers and the costs of operating in rich European markets at the same time. Secondly, foreign firms also target the regions located at the other side of their home frontier, which may feed their trade expansion. As argued in Crozet et al. (2004), the similarity in cultures around the two sides of a same frontier is likely to distort FDI patterns at the benefit of the regions nearby home country. Gravity forces may even extend beyond such regions due to the spatial propagation of preferences. Other features such as natural geographic impediments may also increase the propensity of foreign firms to target some of the border regions at the expense of others, or to locate a bit further away from the border. Hence, Italian firms favor the "Isère" region at the expense of the mountainous "Alpes-de-Haute-Provence", whereas Spanish firms clearly prefer to locate in "Pyrénées atlantiques" and "Pyrénées orientales", where smoother relief allows for pass-roads. The same trend is very salient for British firms, who prefer to locate in "Pas-de-Calais" region, which benefits from the Euro-tunnel connection to the UK. These features stress the heterogeneity of border regions, and the need to qualify their border nature according to the geography of frontiers.

Finally, it is worth noting that exceptions to these two trends, which are found in some regions, confirm some of the conjectures given in section 2.1. For instance, despite its remoteness, the south-central region of "Aveyron", whose exports are strongly oriented towards Germany, hosts a large share of the total German FDI.[5]

3 Trade specifications, data and econometric issues

Section 3 presents the theoretical mechanisms underpinning the interplay between economic integration, multinational activity and trade (Section 3.1), and provides some clue on the data and estimation issues (Section 3.2).

[4]See Combes and Lafourcade (2005) for a more detailed picture of the relative transport accessibility of French regions.
[5]As is well known, Bosch is one of the German affiliates located in this region.

3.1 The augmented gravity model

The representative utility in region i depends on the consumption of the n_{Jt} varieties produced in each foreign partner country J, c_{iJt}.[6] Varieties are differentiated with a constant elasticity of substitution (CES). Goods being heterogeneous across countries, we use the Armington's (1969) assumption that consumers might prefer the varieties produced in some countries at the expense of others: parameter a_{iJt} captures the preference bias of consumers in region i with respect to the varieties produced in J. The utility function in region i is:

$$U_{it} = \left(\sum_{J} \sum_{n_{Jt}} \left(a_{iJt} c_{iJt}\right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \tag{2}$$

where $\sigma > 1$ is the elasticity of substitution between the varieties produced abroad.

Let p_{iJt} denote the delivered price in region i of any variety produced in country J, τ_{iJt}, the *ad valorem* trade cost, and p_{Jt} the mill price in J. We have $p_{iJt} = (1 + \tau_{iJt})\, p_{Jt}$.

It is straightforward to obtain the following expression for imports originating from J:

$$c_{iJt} = c_{it} P_{it}^{\sigma-1} n_{Jt} p_{Jt}^{1-\sigma} a_{iJt}^{\sigma-1} \left(1 + \tau_{iJt}\right)^{1-\sigma}, \tag{3}$$

where $c_{it} = \sum_J \sum_h c_{iJht}$ is total demand in region i for varieties originating from all foreign sources, and P_{it}, the price index in region i, $P_{it} \equiv \left(\sum_J a_{iJt}^{\sigma-1} n_{Jt} p_{iJt}^{1-\sigma}\right)^{1/(1-\sigma)}$.

We assume that trade costs are composed of two different elements: transport costs, T_{iJt}, and specific cross-border costs, B_{iJt}:

$$\left(1 + \tau_{iJt}\right)^{\sigma-1} = T_{iJt} B_{iJt}. \tag{4}$$

Transport costs have the following symmetric structure:

$$T_{iJt} = T_{Jit} = \left(dist_{iJ}\right)^{\delta} exp\left(1 - \beta_1^T bord_{1iJ} - \beta_2^T bord_{2iJ}\right), \tag{5}$$

where $bord_{1iJ}$ and $bord_{2iJ}$ are contiguity dummies capturing the border nature of regions. $bord_{1iJ} = 1$ indicates that the NUTS3 region i shares a frontier with country J (first-order contiguity criterion), while $bord_{2iJ} = 1$ means that, absent strict contiguity, the NUTS3 region i belongs to a NUTS2 region that shares a frontier with country J (second-order contiguity criterion). Moreover, if, absent transport gateways, trade cannot transit through the border of region i to accede market J (due for

[6] In the rest of the paper, small letters will refer to regions and capital letters to countries. The subscript t indicates that the variable is time-variant.

instance to mountains), the two previous dummies are set to 0, which means that region i is treated as interior and not border. Therefore, we capture the "real" border nature of regions by taking into account their endowments in cross-border infrastructures in addition to their location at the political frontier. As cross-border transport connections alleviate the cost of shipping goods through the border, parameters β_1^T and β_2^T are both expected to be positive. Finally, more standardly, transport costs increase with the distance incurred to ship goods between region i and country J, $dist_{iJ}$.

Specific cross-border costs, B_{iJt}, include first tariffs t_{IJt}. The protection structure depends only on bilateral trade agreements signed by countries I and J, which are uniform across border and non-border regions. Advances in European integration are reflected in the progressive removal of tariffs, but also in the alleviation of informal barriers to trade, denoted ntb_{iJt}, that might affect either border or non-border regions differently. We assume:

$$B_{iJt} = (1 + t_{IJt})(1 + ntb_{iJt}) = (1 + fdi_{iJt})^{-\alpha^B}, \tag{6}$$

where fdi_{iJt} is a measure of the *inward* stock of bilateral foreign direct investment.[7]

The relationship between trade barriers and FDI is a rather disputed issue in theory (Neary, 2002; Faini, 2004). Consequently, there is no clear assertion on the question whether multinational activity and trade should be complements or substitutes.[8] On one side, the reduction in trade barriers alleviates the costs for foreign firms of operating outside their home market, which should give multinationals more incentives to fragment production. If region i benefits from lower input costs relatively to other regions, it should be targeted for vertical outsourcing. If foreign affiliates trade back and forth with parent firms located in the home country, there should be a positive causation between FDI and both the imports and exports of the recipient region. Moreover, a number of recent models explain the propensity of more productive firms to self-select into multinational activity.[9] This could generate an additional trade-expanding effect for the recipient regions. A huge body of empirical literature actually supports the evidence that multinational activity and trade would be complementary activities (Lipsey and Weiss, 1981, 1984; Pfaffermayr, 1996; Clausing, 2000; Head and Ries, 2001). However, on the other side, standard theory of multinational corporation predicts a proximity-concentration trade-off which leads firms to outsource production when trade barriers are large and scale economies at the plant level outpace scale economies at the industry level (Brainard, 1997). Therefore, horizontally-motivated

[7]The direction of FDI is therefore assumed to be the same as imports. A proper modeling of border barriers would require the addition of the outward stock, fdi_{Jit}, which would entail more plausible asymmetric trade costs. However, absent data, we have to restrict to inward FDI only.

[8]Forte (2004) provides an exhaustive survey of both the theoretical and empirical literatures on this question.

[9]See among others Bernard et al. (2003), Melitz (2003), Helpman et al. (2004).

overseas production could substitute for exports to the home country. In addition, if foreign affiliates deter the entry of local producers (for goods, as for production factors), multinational activities could also depress the domestic part of the region's trade. Hence, we expect α^B to be either positive or negative, depending on whether the complementarity-expanding effects offset the substitution-depressing influences.

Preferences integrate deterministic as well as stochastic elements:

$$a_{iJt}^{\sigma-1} = (1 + fdi_{iJt})^{\alpha^a} \exp[\beta_1^a bord_{1iJ} + \beta_2^a bord_{2iJ} + \varepsilon_{iJt}], \tag{7}$$

where ε_{iJt} is the random component. FDI affects these Armington preferences because it is more likely to occur the more similar the home and the recipient markets are. In return, if the presence of multinationals is a conduit for both a better knowledge of foreign goods and a better adaptation of these goods to local tastes, parameter α^a is expected to be positive. The border dummy $bord_{1iJ}$ captures the existence of possibly close ties between consumers located on both sides of the same frontier. As the propagation of preferences might extend outside the frontier of strictly contiguous regions, especially if those are small areas, we also introduce $bord_{2iJ}$. If consumers living in border regions have a larger propensity to share the tastes of the nearby country than other regions, we expect parameters β_1^a and β_2^a to be both positive, though β_2^a should be of lower magnitude than β_2^a due to the distance decay.

Taking logs and plugging back expressions (4), (5), (6) and (7) into equation (3), we obtain the following log-specification for imports:

$$\begin{aligned} \ln c_{iJt} &= 1 + \ln c_{it} + (\sigma - 1) \ln P_{it} + \ln n_{Jt} + (1 - \sigma) \ln p_{Jt} \\ &\quad -\delta \ln dist_{iJ} + \alpha \ln (1 + fdi_{iJt}) + \beta_1 bord_{1iJ} + \beta_2 \mathrm{bord}_{2iJ} + \varepsilon_{iJt} \end{aligned} \tag{8}$$

where $\alpha = \alpha^a + \alpha^B$, $\beta_1 = \beta_1^T + \beta_1^a$, $\beta_2 = \beta_2^T + \beta_2^a$.

The bias in consumers' preferences affects only the imports of varieties originating from nearby countries. Therefore, exports can be readily derived from the following restrictions: $\alpha^a = \beta_1^a = \beta_2^a = 0$.

3.2 Trade specifications and econometric issues

Equation (8) involves three groups of variables: Origin (J-specific), destination (i-specific) and "dyadic" (or bilateral iJ-specific). In order to tackle the problem that non-dyadic variables c_{it}, P_{it}, n_{Jt} and p_{Jt} cannot be accurately measured, we adopt a two-way fixed-effect approach and replace all destination-specific and origin-specific variables by two groups of dummies.[10] The import specification we estimate is the following:

$$\ln c_{iJt} = \theta + f_{it} + f_{Jt} - \delta \ln dist_{iJ} + \alpha \ln (1 + fdi_{iJt}) + \beta_1 bord_{1iJ} + \beta_2 bord_{2iJ} + f_t + \varepsilon_{iJt}, \qquad (9)$$

where f_t is a year-dummy capturing the unobserved time-dependent factors affecting flows identically across regions and countries, and where f_{it} and f_{Jt} are respectively destination- and origin-specific dummies interacted with the previous.

Independently of trade direction, the FDI explanatory variable is potentially endogenous in equation (9), as the location choice of foreign firms is likely to depend on the trade activity itself. To overcome this simultaneity problem, we use the method of instrument variables and estimate the model by 2SLS. Hence, we have to find at least one variable that is partially correlated with FDI (but not with trade), once all the other right-hand-side exogenous variables of equation (9) have been netted out. Therefore, the IV candidate must be dyadic (i.e. iJ-specific), otherwise it would be strictly collinear with either the origin or the destination fixed-effects.[11] We choose the following instrument:

$$MP_{iJt}^{1993} = \sum_{k \in I(\neq i)} \frac{emp_{kJt}}{gtc_{ki}^{1993}}, \qquad (10)$$

where emp_{kJt} is the total employment of all the J affiliates located in region k, and gtc_{iJ} is the generalized domestic transport cost incurred to ship manufacturing goods from region i to region k in 1993.[12] Therefore, MP_{iJt}^{1993} is a French market potential variable capturing the propensity of foreign firms to locate at the vicinity of the largest affiliates from the same home country, which proved to be highly correlated with FDI location in previous empirical studies (for instance Crozet et al., 2004). To avoid any additional bias arising from potentially endogenous transport infrastructures (since greater amounts of public funds might be devoted to the main FDI recipient regions), we compute market potentials based on the value of transport costs at the beginning of the sample period, i.e. 1993.

The first-stage regression consists here in estimating the following FDI specification:

$$\ln (1 + fdi_{iJt}) = \rho + f_{it} + f_{Jt} - \gamma \ln dist_{iJ} + \phi ln\, (1 + MP_{iJt}) + \varphi_1 bord_{1iJ} + \varphi_2 bord_{2iJ} + f_t + \xi_{iJt}. \qquad (11)$$

[10] Empirically, including fixed-effects is actually the most widely accepted means of obtaining theory-consistent estimates for gravity equations. See for instance Bergstrand (1985), Hummels (1999), or Anderson and van Wincoop (2003).

[11] In standard empirical analysis (discrete choice or gravity models), FDI specifications include a set of variables related to the recipient region (local taxes, wages, GDP, ...) and to the home country. We cannot use such variables as instruments here, because they are already captured by either f_{it} or f_{Jt}.

[12] Combes and Lafourcade (2005) provide a full description of this variable.

The IV estimator for α derives from the following second-stage regression:

$$\ln c_{iJt} = \theta + f_{it} + f_{Jt} - \delta \ln dist_{iJ} + \alpha[\ln(\widehat{1 + fdi_{iJt}})] + \beta_1 bord_{1iJ} + \beta_2 bord_{2iJ} + f_t + \epsilon_{iJt}. \qquad (12)$$

The IV estimator is consistent under the hypothesis that the market potential and FDI variables are *effectively* partially correlated. Absent additional exclusion restrictions, the model is just identified and, therefore, condition $\phi \neq 0$ must hold.

3.3 Definition of border regions

As noted in Section 2, caution is needed to define border regions properly. Several French border regions, although they share a frontier with a neighboring country, do not necessarily benefit from a direct access to this country, mostly because of physical geography (sea, mountains, ...). Therefore, we run two sets of regressions that build on two different definitions of border regions. Firstly, we adopt a large definition based on a simple contiguity bilateral criterion.[13] We consider that all the regions sharing a frontier with at least one neighboring country, by land or by sea, are border regions.[14] Secondly, we restrict the definition of border regions to the subset of contiguous regions which are effectively well connected to the nearby country, *i.e.* the regions hosting good cross-border transport infrastructures (major highways, tunnels or harbors).[15] Using the two sets of estimates, we can compare the trade performances of both types of border regions and quantify the contribution of transport corridors to these performances, a prominent issue for policy-makers.

4 The trade performance of border and non-border regions

In this section, we present two sets of estimations. In the first set, presented in Section 4.1, we analyze the trade performance of border regions relatively to interior regions over the whole period 1978-2000. Although this approach neglects the causal relationship between multinational activity and trade, it makes possible to break down the sample into different sub-periods and to analyze the changes in trade performances occurring throughout the successive integration episodes. By way of contrast, Section 4.2 provides further estimates which are structurally-consistent. However, due to data constraint, the relationship between trade performances and FDI can only be investigated properly for the period 1993-2000.

[13]See Appendix B for detailed listing and mapping.

[14]With respect to the UK, we consider all regions bordering the English Channel.

[15]See Appendix B for detailed listing and mapping. To avoid any bias due to the possible simultaneity of trade and infrastructure endowments, we consider only the transport infrastructures built before the period under study.

4.1 Baseline regressions: 1978-2000

Table 1 reports the OLS estimates derived from estimating equation (9), absent FDI in the right-hand side explanatory variables. We consider the trade of French regions with the five neighboring countries of France. Hence, in our estimation, the trade partner country J can only be Belgium-Luxembourg, Germany, UK, Spain or Italy. Columns (P), (X) and (M) report the coefficients estimated over respectively pooled flows, exports and imports.

Table 1: The average trade outperformance of French border regions

	Dependent Variable: log of trade value					
Border regions	All contiguous			Transport corridors		
Model :	(P)	(X)	(M)	(P)	(X)	(M)
$ln\,(dist)$	-0.60^a	-0.46^a	-0.74^a	-0.64^a	-0.45^a	-0.84^a
	(0.07)	(0.10)	(0.09)	(0.06)	(0.08)	(0.07)
$bord_1$	0.54^a	0.33^b	0.76^a	0.76^a	0.57^a	0.96^a
	(0.11)	(0.13)	(0.16)	(0.13)	(0.14)	(0.21)
$bord_2$	0.24^a	0.12	0.35^a	0.25^a	0.17	0.33^a
	(0.07)	(0.11)	(0.09)	(0.08)	(0.11)	(0.09)
N	21620	10810	10810	21620	10810	10810
R^2	0.879	0.904	0.921	0.881	0.906	0.923
RMSE	0.579	0.520	0.520	0.575	0.515	0.515

Notes: (i) Specification estimated: $\ln(c_{iJt}) = \theta - \delta \ln(dist_{iJ}) + \beta_1 bord_{1iJ} + \beta_2 bord_{2iJ} + f_{it} + f_{Jt} + f_t + \varepsilon_{iJt}$. (ii) Heteroskedasticity-robust standard errors in brackets, with ^{a}, ^{b} and ^{c} denoting significance at the 1%, 5% and 10% levels, respectively. Fixed-effects are not reported.

A first overall conclusion to be drawn from Table 1 is that, everything else equal, border regions trade substantially more with the country with whom they share a frontier than do interior regions. The magnitude of this trade outperformance is considerably larger for first-order than for second-order border regions (i.e. $bord_1 > bord_2$): the former trade on average 72% more ($[exp(0.54) - 1] \times 100$) than interior regions, whereas the trade deviation is 27% only ($[exp(0.24) - 1] \times 100$) for the latter. As expected, border regions endowed with good cross-border transport connections outperform even better, with an average trade outperformance of 114% ($[exp(0.76) - 1] \times 100$). Trade deviations with respect to the gravity norm are globally larger for imports than for exports, which means that $\beta_1^a > 0$ and $\beta_2^a > 0$ in equation (8). This is consistent with the model's assumption that consumers' preferences would be biased in favor of the differentiated goods imported from nearby countries or, in other words, that countries would actually export more to the regions located at the other side of their frontier than to other regions, due to "cultural" proximity.

Beyond simple average, one might wonder how relative trade performances have evolved over the last two decades of EU integration. A dynamic perspective is even more illuminating, given that NEG models mostly build on comparative statics and do not generally account for long-term evolutions.

The drawback of time-series analysis here is that different integration episodes might have affected French trade at the same time. Indeed, although EU reforms become effective at a formal date, their impact is actually largely anticipated, and changes are likely to occur even earlier than the time of implementation. Therefore, we cannot reasonably capture the changes induced by integration with a standard difference-in-difference approach. To overcome the issue of scheduling European integration, we choose to follow trade performances throughout the period 1978-2000 and to check whether significant changes occurred around the time of main formal reforms, that is around the Single European Act (1986), the Schengen Agreement (1990), the Maastricht (1992) treaty, and the successive EU enlargements to Greece (1981), Spain, Portugal (1986), Austria, Finland and Sweden (1996). More precisely, we adopt two different approaches. First, we keep on working with trade flows pooled over years. We thus interact border and time dummies so as to test for significant changes in the coefficients from year to year. Secondly, we undertake further estimations based on yearly trade sub-samples, in order to test whether the border regions located at the vicinity of the EU core exhibit specific trends in comparison with the border regions located at the periphery of western Europe.

Table 2 reports the results of the first set of estimations. Throughout the period 1978-2000, we observe a progressive fall in the trade outperformance of border regions. While the regions bordering a country used to trade around twice more with this country than their interior counterparts in 1978, they end with a lead of only 52.2% in 2000. The same declining trend is experienced by transport corridors, whose trade outperformances were cut up by nearly a half on the same period.

Hence, the benefits of acceding to new foreign markets would be offset by the loss induced by increasing import competition throughout the European process of integration. However, counter forces seem to have acted against the decline by the time of two main integration episodes, that is slightly before the Single European Act of 1986 and slightly after the Schengen Agreement of 1990.

In the second set of estimations, we proceed with year-by-year regressions over pooled over imports and exports, for different sub-samples of partner countries. Figure 4-(a) reports the time changes in the average trade performances of border regions, computed as $[exp(\beta) - 1] \times 100$, where β is the coefficient related to the year of estimation.[16] The range of estimates is very similar to that obtained previously. In addition, we see that the gap between well and bad connected border regions narrows throughout the integration process (as reflected by converging thick and thin lines). The reason might be that "gateway" regions did not experience major infrastructure improvements during the period 1978-2000, while their counterparts did.[17]

[16] Related estimation tables are available upon request. Unless mentioned, the β coefficients used to compute trade

Table 2: Time changes in the trade performance of French border regions

	Dependent Variable: log of trade value					
Border regions	All contiguous			Transport corridors		
Model :	(P)	(X)	(M)	(P)	(X)	(M)
$ln(dist)$	-0.60^a	-0.46^a	-0.74^a	-0.64^a	-0.45^a	-0.84^a
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
$bord_2$	0.24^a	0.12^a	0.35^a	0.25^a	0.17^a	0.33^a
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
$bord_1 \times f_{1978}$	0.67^a	0.38^b	0.96^a	0.92^a	0.73^a	1.11^a
	(0.12)	(0.15)	(0.16)	(0.15)	(0.17)	(0.22)
$bord_1 \times f_{1979}$	0.74^a	0.57^a	0.91^a	0.94^a	0.78^a	1.11^a
	(0.11)	(0.15)	(0.16)	(0.14)	(0.18)	(0.22)
$bord_1 \times f_{1980}$	0.60^a	0.36^a	0.83^a	0.83^a	0.68^a	0.99^a
	(0.11)	(0.14)	(0.16)	(0.14)	(0.16)	(0.22)
$bord_1 \times f_{1981}$	0.63^a	0.44^a	0.82^a	0.82^a	0.65^a	0.99^a
	(0.11)	(0.16)	(0.17)	(0.15)	(0.19)	(0.23)
$bord_1 \times f_{1982}$	0.64^a	0.41^a	0.87^a	0.85^a	0.64^a	1.05^a
	(0.11)	(0.15)	(0.17)	(0.15)	(0.19)	(0.23)
$bord_1 \times f_{1983}$	0.64^a	0.36^b	0.93^a	0.86^a	0.58^a	1.13^a
	(0.11)	(0.14)	(0.17)	(0.15)	(0.18)	(0.24)
$bord_1 \times f_{1984}$	0.57^a	0.28^b	0.87^a	0.85^a	0.58^a	1.11^a
	(0.11)	(0.13)	(0.17)	(0.14)	(0.15)	(0.24)
$bord_1 \times f_{1985}$	0.55^a	0.32^b	0.78^a	0.82^a	0.57^a	1.06^a
	(0.11)	(0.13)	(0.18)	(0.14)	(0.16)	(0.24)
$bord_1 \times f_{1986}$	0.55^a	0.29^b	0.80^a	0.82^a	0.53^a	1.11^a
	(0.11)	(0.13)	(0.17)	(0.14)	(0.15)	(0.22)
$bord_1 \times f_{1987}$	0.54^a	0.28^b	0.81^a	0.81^a	0.54^a	1.07^a
	(0.10)	(0.12)	(0.16)	(0.13)	(0.14)	(0.21)
$bord_1 \times f_{1988}$	0.53^a	0.29^b	0.77^a	0.83^a	0.59^a	1.07^a
	(0.10)	(0.12)	(0.16)	(0.13)	(0.14)	(0.21)
$bord_1 \times f_{1989}$	0.52^a	0.30^b	0.73^a	0.82^a	0.62^a	1.01^a
	(0.10)	(0.12)	(0.16)	(0.12)	(0.15)	(0.19)
$bord_1 \times f_{1990}$	0.48^a	0.27^b	0.68^a	0.76^a	0.57^a	0.95^a
	(0.10)	(0.13)	(0.15)	(0.12)	(0.16)	(0.19)
$bord_1 \times f_{1991}$	0.51^a	0.30^a	0.73^a	0.77^a	0.58^a	0.97^a
	(0.10)	(0.12)	(0.15)	(0.12)	(0.15)	(0.20)
$bord_1 \times f_{1992}$	0.50^a	0.28^b	0.72^a	0.76^a	0.55^a	0.96^a
	(0.10)	(0.12)	(0.16)	(0.12)	(0.14)	(0.21)
$bord_1 \times f_{1993}$	0.52^a	0.32^a	0.72^a	0.73^a	0.51^a	0.95^a
	(0.10)	(0.10)	(0.17)	(0.13)	(0.11)	(0.23)
$bord_1 \times f_{1994}$	0.50^a	0.30^a	0.71^a	0.68^a	0.48^a	0.87^a
	(0.09)	(0.09)	(0.16)	(0.12)	(0.10)	(0.22)
$bord_1 \times f_{1995}$	0.48^a	0.30^a	0.66^a	0.67^a	0.50^a	0.84^a
	(0.09)	(0.09)	(0.15)	(0.12)	(0.10)	(0.21)
$bord_1 \times f_{1996}$	0.50^a	0.34^a	0.65^a	0.67^a	0.52^a	0.83^a
	(0.09)	(0.09)	(0.15)	(0.11)	(0.10)	(0.21)
$bord_1 \times f_{1997}$	0.47^a	0.32^a	0.62^a	0.63^a	0.47^a	0.78^a
	(0.08)	(0.08)	(0.15)	(0.11)	(0.09)	(0.21)
$bord_1 \times f_{1998}$	0.48^a	0.33^a	0.64^a	0.60^a	0.48^a	0.72^a
	(0.09)	(0.08)	(0.15)	(0.12)	(0.10)	(0.22)
$bord_1 \times f_{1999}$	0.46^a	0.27^a	0.65^a	0.59^a	0.44^a	0.74^a
	(0.09)	(0.09)	(0.15)	(0.12)	(0.10)	(0.22)
$bord_1 \times f_{2000}$	0.42^a	0.32^a	0.53^a	0.58^a	0.53^a	0.63^a
	(0.08)	(0.10)	(0.12)	(0.10)	(0.12)	(0.16)
N	21620	10810	10810	21620	10810	10810
R^2	0.998	0.998	0.998	0.998	0.998	0.998
RMSE	0.579	0.520	0.520	0.575	0.515	0.515

Notes: Heteroskedasticity-robust standard errors in brackets, with ^{a}, ^{b} and ^{c} denoting significance at the 1%, 5% and 10% levels, respectively.

To gain more insights, we divide the trade sample into the four following group of trade partner countries. The first sub-sample, which is composed of trade with Belgium-Luxembourg and Germany, puts the emphasis on the trends experienced by the regions bordering the EU core. The second sub-sample adds to the previous trade with the UK, which extends the focus to the border of North-EU. The third sub-sample includes trade with Spain and Italy in order to isolate southern border regions, whereas the last sub-sample, which adds to the previous trade with UK provides some clue on what is experienced at the western EU periphery.

As depicted in Figure 4-(b), absent a brief growth episode around the Single European Act of 1986, the Northern French border regions have rather stagnated over the period 1978-2000. This stable pattern hides a recent increase in the outperformances experienced by the regions bordering the EU core (Figure 4-(c)) and thus, a counterpart decline of the regions bordering UK. By contrast, the trade outperformance of southern border regions fell drastically during the same period (Figure 4-(d)), from 320% (494% for transport corridors) down to 103% (123% for transport corridors) in 2000. As this trend still holds true, once considered the regions bordering UK (Figure 4-(e)), the depressing prospect can be enlarged to all the border regions located at the western periphery of Europe. However, as previously, slowdowns in the fall occur namely around the time of the Single Act, Spain's entry into the EU, and the Schengen agreement.

What could explain that the trade performances of French border regions depress at the western and southern periphery of Europe, while they raise at the vicinity of the EU core ? In Section 4.2, we investigate the role of multinationals in shaping such differentials.

4.2 The interplay between trade performances and FDI: 1993-2000

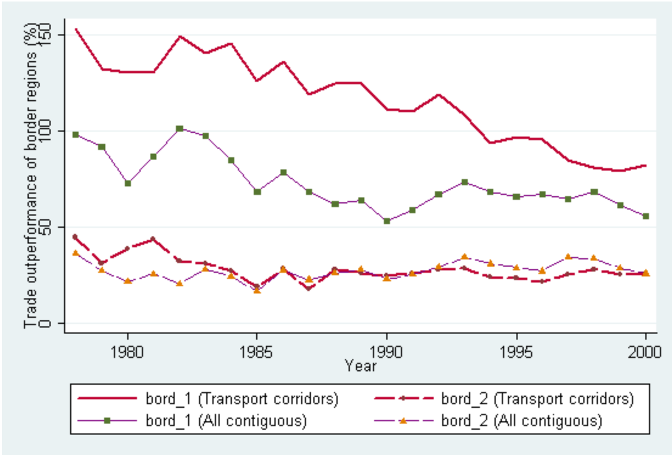
This section aims to assess the share of trade differentials explained by multinational location strategies, on the period 1993-2000, for which FDI stocks are available for French regions. As in subsection 4.1, we first examine the average impact of FDI on trade performances for the whole period. We next interact the explanatory variables with time dummies to allow effects to change over time. Tables 3 and 4 display the results of this first set of estimations.

As a benchmark, column (B) in Table 3 reports the OLS results of estimating equation (9), excluding FDI from the right-hand side explanatory variables, on the 1993-2000 sub-sample of flows pooled over exports and imports. Column (P1) provides the 2SLS estimates of structural equation (12), whereas column (P2) (respectively (P3)) interacts FDI with the first-order (respectively second-order)

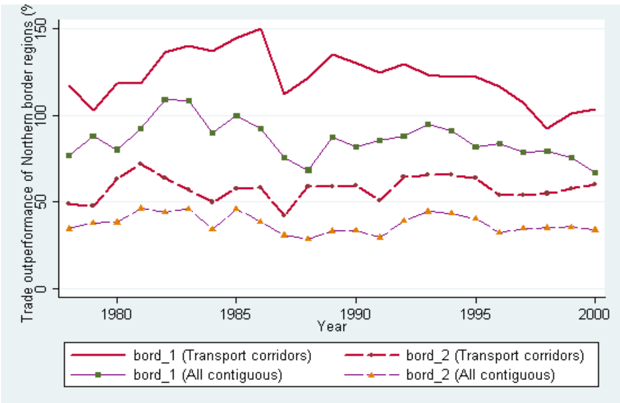
deviations from the gravity norm are significantly different from zero at the level of 5% at least.

[17] For instance, transport connections between Spain and the French border regions of "Ariège" and between Italy and the French border region of "Alpes-de-Haute-Provence" improved respectively with the opening of the Puymorens tunnel and the Larche pass road in 1994.

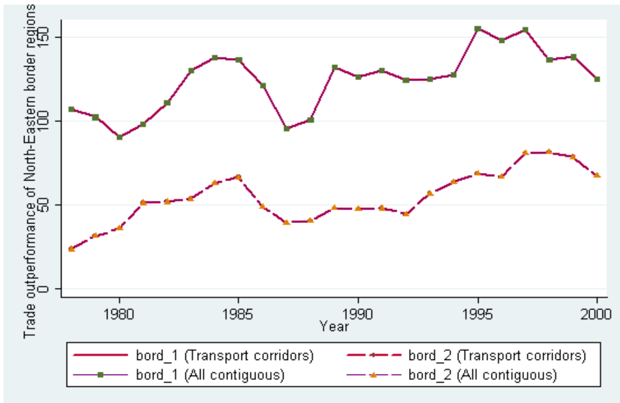
Figure 4: Changes in the trade performances of French border regions by group of partner countries



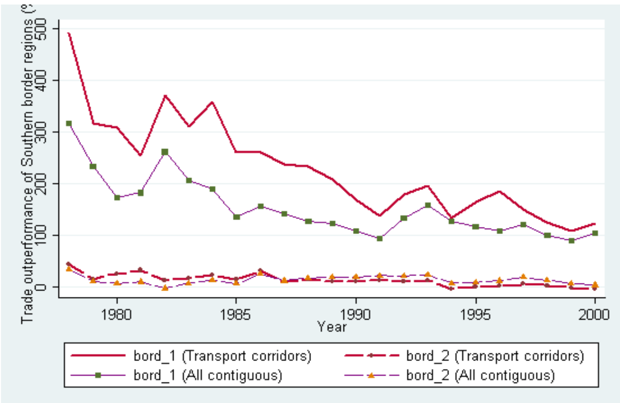
(a) Average



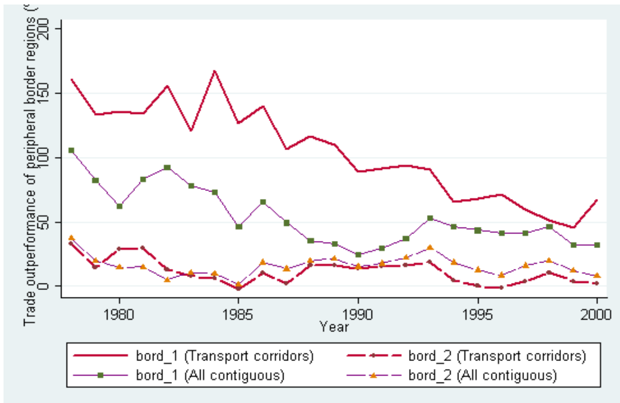
(b) Northern EU border



(c) Border of EU core



(d) Southern EU border



(e) Border of EU periphery

Table 3: The average trade-expanding impact of FDI on pooled flows

	Dependent Variable: log of trade value									
Border regions	All contiguous					Transport corridors				
Model :	(B)	(P1)	(P2)	(P3)	(P4)	(B)	(P1)	(P2)	(P3)	(P4)
$ln(dist)$	-0.57^a	-0.45^a	-0.45^a	-0.44^a	-0.50^a	-0.65^a	-0.53^a	-0.51^a	-0.53^a	-0.57^a
	(0.03)	(0.05)	(0.05)	(0.06)	(0.07)	(0.03)	(0.05)	(0.05)	(0.07)	(0.08)
$bord_1$	0.50^a	0.27^a	0.56^a	0.22^c	0.27^a	0.64^a	0.31^b	0.85^a	0.32^c	0.31^b
	(0.04)	(0.09)	(0.07)	(0.12)	(0.09)	(0.05)	(0.13)	(0.12)	(0.19)	(0.13)
$bord_2$	0.26^a	0.23^a	0.21^a	0.29^a	0.23^a	0.22^a	0.17^a	0.16^a	0.16^b	0.18^a
	(0.03)	(0.04)	(0.04)	(0.06)	(0.04)	(0.03)	(0.04)	(0.04)	(0.07)	(0.04)
$ln(1+fdi)$		0.53^a					0.51^a			
		(0.17)					(0.19)			
$ln(1+fdi)\times bord_1$			0.31^a					0.20		
			(0.11)					(0.13)		
$ln(1+fdi)\times(1-bord_1)$			0.61^a					0.61^a		
			(0.20)					(0.21)		
$ln(1+fdi)\times bord_2$				0.51^a					0.51^a	
				(0.17)					(0.17)	
$ln(1+fdi)\times(1-bord_2)$				0.63^a					0.50^c	
				(0.23)					(0.27)	
$ln(1+fdi)\times core$					0.60^a					0.57^a
					(0.14)					(0.16)
$ln(1+fdi)\times(1-core)$					0.30					0.27
					(0.31)					(0.33)
N	7520	7520	7520	7520	7520	7520	7520	7520	7520	7520
R^2	0.857	0.845	0.841	0.838	0.852	0.858	0.846	0.841	0.846	0.853
RMSE	0.559	0.582	0.589	0.595	0.568	0.557	0.580	0.589	0.579	0.566
Hausman ($Prob > F$)		0.0115	0.0002	0.0071	0.0000		0.0195	0.0004	0.0012	0.0000

Note: Heteroskedasticity-robust standard errors in brackets, with ^{a}, ^{b} and ^{c} denoting significance at the 1%, 5% and 10% levels, respectively. Fixed-effects are not reported. "Hausman" provides the p-value of the Fisher test for significance of $\widehat{\xi_{iJt}}$ in structural equation (9). A p-value < 0.05 means that the null of the FDI exogeneity is rejected at the 5% significance level.

border region dummy, in order to disentangle its marginal impact between border and interior regions. In the same spirit, column (P4) interacts FDI with a core border region dummy (defined independently of the partner country),[18] so as to assess whether trade differentials exist due to the presence of foreign affiliates either from the nearby country, or from the other countries in the sample. Table 4 reports similar results for the sample of respectively exports (columns (X1), (X2), (X3) and (X4)) and imports (columns (M1), (M2), (M3) and (M4)).

As can be seen in Table 3, there is a strong positive relationship between inward multinational activity and trade. A 10% increase in the foreign stock of affiliates entails a 5.3% increase in trade with the parent country. This net complementarity is significantly larger for exports (8%) than for imports (2.6%), which casts doubt on the existence of a bias in consumers's preferences that would be conveyed by the FDI channel. As the α estimates are not significantly different from 0 in most import specifications, this could be evidence that border regions are mostly export platforms towards nearby countries. In most of the estimations, we cannot reject the null of exogeneity of FDI at the 5% significance level, which means that 2SLS are consistent estimators. Incidentally, in all the first-stage regressions, the stock of FDI is actually partially correlated with our market potential variable, which makes us confident in the validity of this instrument.[19]

More importantly, we see that augmenting the gravity specification with FDI greatly reduces the coefficients of the $bord_1$ variable. For the border regions defined according to a strict contiguity criterion, the deviation from the gravity norm falls from 64.9% ($[exp(0.50) - 1] \times 100$) to 31% ($[exp(0.27) - 1] \times 100$), whereas transport corridors face a similar fall in their lead place, from 89.6% ($[exp(0.64) - 1] \times 100$) to 36.3% ($[exp(0.31) - 1] \times 100$). Present FDI in the gravity specification, transport corridors do not longer outperform regarding exports. Therefore, nearly half of the trade outperformance of first-order border regions is actually due to the presence of foreign affiliates from the nearby country.[20] However, the elasticity of trade with respect to FDI is actually significantly larger within the group of interior regions (0.61) than within that of first-order border regions (either 0.31 or 0.20 depending on their subjacent definition). Nonetheless, we have to bear in mind that the regions who share a frontier with a country host, on average, around 14 times more affiliates from this country than interior regions. Therefore, although the trade-expanding effect of each additional affiliate is larger for interior than for border regions, this is compatible with an average trade-creating impact of FDI larger for the former than for the latter.

[18] Which means that "core" is a dummy taking the value 1 whenever trade observed relates to a region located at the Belgium-Luxembourg or at the German borders (whatever trade concerns these countries or not). See Appendix B for a precise listing of these regions.

[19] Which means that a two-tailed Student test leads to reject the null that $\phi = 0$ in equation 11, at the 5% critical

Table 4: The average trade-expanding impact of FDI on either imports or exports

	Dependent Variable: log flow															
Border regions	All contiguous								Transport corridors							
Model :	(X1)	(M1)	(X2)	(M2)	(X3)	(M3)	(X4)	(M4)	(X1)	(M1)	(X2)	(M2)	(X3)	(M3)	(X4)	(M4)
$ln(dist)$	-0.28^a	-0.62^a	-0.28^a	-0.62^a	-0.25^b	-0.62^a	-0.28^b	-0.71^a	-0.30^a	-0.75^a	-0.29^a	-0.73^a	-0.28^b	-0.78^a	-0.29^b	-0.86^a
	(0.08)	(0.06)	(0.08)	(0.06)	(0.10)	(0.07)	(0.11)	(0.09)	(0.08)	(0.06)	(0.09)	(0.07)	(0.11)	(0.08)	(0.13)	(0.11)
$bord_1$	-0.04	0.58^a	0.27^a	0.84^a	-0.13	0.57^a	-0.04	0.58^a	-0.12	0.75^a	0.37^a	1.33^a	-0.21	0.85^a	-0.12	0.74^a
	(0.13)	(0.11)	(0.08)	(0.13)	(0.18)	(0.15)	(0.13)	(0.12)	(0.20)	(0.17)	(0.11)	(0.25)	(0.31)	(0.25)	(0.20)	(0.19)
$bord_2$	0.15^a	0.30^a	0.14^a	0.29^a	0.26^a	0.31^a	0.15^a	0.31^a	0.07	0.27^a	0.06	0.26^a	0.14	0.18^b	0.06	0.29^a
	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)	(0.07)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.10)	(0.09)	(0.07)	(0.06)
$ln(1+fdi)$	0.80^a	0.26							0.88^a	0.14						
	(0.27)	(0.21)							(0.30)	(0.22)						
$ln(1+fdi) \times bord_1$			0.57^a	0.06							0.60^a	-0.19				
			(0.16)	(0.15)							(0.19)	(0.19)				
$ln(1+fdi) \times (1-bord_1)$			0.88^a	0.33							0.97^a	0.24				
			(0.30)	(0.24)							(0.34)	(0.26)				
$ln(1+fdi) \times bord_2$					0.76^a	0.25							0.86^a	0.16		
					(0.28)	(0.20)							(0.30)	(0.21)		
$ln(1+fdi) \times (1-bord_2)$					0.98^a	0.29							1.00^b	0.00		
					(0.37)	(0.27)							(0.46)	(0.33)		
$ln(1+fdi) \times core$							0.79^a	0.41^b							0.87^a	0.26
							(0.21)	(0.18)							(0.26)	(0.21)
$ln(1+fdi) \times (1-core)$							0.81^c	-0.22							0.94^c	-0.41
							(0.48)	(0.40)							(0.55)	(0.45)
N	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760	3760
R^2	0.844	0.909	0.837	0.907	0.818	0.909	0.842	0.901	0.830	0.911	0.823	0.908	0.812	0.909	0.822	0.891
RMSE	0.561	0.508	0.572	0.515	0.606	0.510	0.564	0.533	0.585	0.505	0.598	0.512	0. 615	0.509	0.598	0.556
Hausman ($Prob > F$)	0.0002	0.6140	0.0007	0.0057	0.0005	0.3218	0.0000	0.0000	0.0001	0.9949	0.0004	0.0053	0.0000	0.1427	0.0000	0.0000

Note: Heteroskedasticity-robust standard errors in brackets, with ^{a}, ^{b} and ^{c} denoting significance at the 1%, 5% and 10% levels, respectively. Fixed-effects are not reported. "Hausman" provides the p-value of the Fisher test for significance of $\widehat{\xi_{iJt}}$ in structural equations (9). A p-value < 0.05 means that the null of the FDI exogeneity is rejected at the 5% significance level.

By disentangling further the effect of FDI within two additional groups, we see that not only core border regions benefit from a larger FDI trade-creating impact on average, but also at the margin. Indeed, the α coefficient is larger within the group of core regions (around 0.6) than elsewhere (around 0.3, but insignificant).

Finally, the distance coefficients also reduce consequently to the inclusion of FDI into the gravity specification. Hence, distance actually captures other effects than spatial proximity, and merely effects conveyed by variables that are negatively correlated with FDI, such as tariffs, information or jurisdiction costs. Therefore, spatial proximity matters for trade, but in a quite complex way that goes beyond the impact of shipment costs or "physical" geography.

Tables 5 and 6 provide further insights regarding the trade dynamics observed on the period 1993-2000. The main explanatory variables are thus interacted with year dummies in order to show the time trends experienced by their coefficients. As previously, in Table 5, column (B) reports the results of estimating equation (9) (excluding FDI from the specification) on the 1993-2000 sub-sample of pooled flows. Columns (P1), (X1) and (M1) provide the 2SLS estimates of structural equation (12) for respectively the pooled, exports and import flows, whereas columns (P2), (X2) and (M2) (respectively (P4), (X4) and (M4) in Table 6) disentangles the marginal impact of FDI within the group of border and interior regions .

Column (P1) in Table 5 shows that, once controlled for inward FDI, the trade outperformance of border regions is drastically reduced: the positive trade deviation from the gravity norm falls and becomes insignificant for nearly all the period 1993-2000. Furthermore, the trade-creating effect of inward FDI diminishes in magnitude (it is divided by nearly 7 from 1993 to 2000), and loses significance over time, until becoming insignificant for the most recent years of observation. This could indicate an increasing orientation of foreign firms towards the French market. Over time, foreign affiliates both sell more to French consumers or firms and buy more from French suppliers, and hence, reduce their trade with the origin country. However, this effect is not sufficiently strong to eliminate the trade creating impact of FDI over the whole period 1993-2000. Even though horizontal motives seem to become prevalent over time, overall, FDI appears as a complement rather than a substitute for trade.

The erosion of the trade expanding impact of foreign affiliates is lower for interior than border regions, the FDI elasticity being divided by 5.5 on the same period. Therefore, decreasing returns to scale in the benefits of FDI seem to prevail over the period 1993-2000.

level. Related results are available upon request.

[20]By contrast, multinational activities only slightly affect the coefficient on second-order border regions.

Table 5: Time changes in the average trade-expanding impact of FDI

Model :	Dependent Variable: log flow (B)	(P1)	(X1)	(M1)	(P2)	(X2)	(M2)
$ln(dist)$	-0.57[a]	-0.42[a]	-0.24[c]	-0.61[a]	-0.43[a]	-0.25[b]	-0.61[a]
	(0.03)	(0.07)	(0.13)	(0.07)	(0.06)	(0.10)	(0.07)
$bord_2$	0.26[a]	0.23[a]	0.17[a]	0.30[a]	0.22[a]	0.16[a]	0.29[a]
	(0.03)	(0.04)	(0.06)	(0.05)	(0.04)	(0.06)	(0.05)
$bord_1 \times f_{1993}$	0.54[a]	0.23	-0.18	0.64[a]	0.53[b]	0.31	0.74[b]
	(0.10)	(0.25)	(0.52)	(0.24)	(0.24)	(0.38)	(0.37)
$bord_1 \times f_{1994}$	0.53[a]	0.01	-0.42	0.44	0.35	0.07	0.63[b]
	(0.09)	(0.31)	(0.59)	(0.31)	(0.22)	(0.35)	(0.32)
$bord_1 \times f_{1995}$	0.50[a]	0.25	-0.15	0.65[a]	0.41	-0.02	0.85[c]
	(0.09)	(0.20)	(0.35)	(0.25)	(0.25)	(0.26)	(0.51)
$bord_1 \times f_{1996}$	0.52[a]	0.32[c]	-0.04	0.67[a]	0.61[b]	0.20	1.02[c]
	(0.09)	(0.17)	(0.26)	(0.24)	(0.28)	(0.18)	(0.58)
$bord_1 \times f_{1997}$	0.49[a]	0.23	0.03	0.43[c]	0.58[b]	0.15	1.01[c]
	(0.09)	(0.18)	(0.24)	(0.26)	(0.27)	(0.18)	(0.58)
$bord_1 \times f_{1998}$	0.51[a]	0.32[c]	0.07	0.57[b]	0.70[b]	0.30	1.10[c]
	(0.09)	(0.19)	(0.26)	(0.27)	(0.27)	(0.20)	(0.57)
$bord_1 \times f_{1999}$	0.48[a]	0.33	0.07	0.60[c]	0.70[a]	0.30	1.10[b]
	(0.09)	(0.22)	(0.28)	(0.31)	(0.26)	(0.19)	(0.52)
$bord_1 \times f_{2000}$	0.45[a]	0.33	0.18	0.49	0.59[b]	0.55[b]	0.62[c]
	(0.08)	(0.22)	(0.29)	(0.30)	(0.23)	(0.26)	(0.36)
$ln(1+fdi) \times f_{1993}$		1.90[c]	3.00	0.81			
		(1.02)	(2.13)	(0.89)			
$ln(1+fdi) \times f_{1994}$		1.53[b]	2.16	0.90			
		(0.71)	(1.37)	(0.69)			
$ln(1+fdi) \times f_{1995}$		0.68[c]	1.16[c]	0.21			
		(0.38)	(0.67)	(0.41)			
$ln(1+fdi) \times f_{1996}$		0.48[c]	0.82[c]	0.13			
		(0.26)	(0.43)	(0.31)			
$ln(1+fdi) \times f_{1997}$		0.52[b]	0.63[c]	0.41			
		(0.25)	(0.38)	(0.31)			
$ln(1+fdi) \times f_{1998}$		0.41	0.58	0.24			
		(0.25)	(0.39)	(0.31)			
$ln(1+fdi) \times f_{1999}$		0.35	0.50	0.20			
		(0.29)	(0.42)	(0.35)			
$ln(1+fdi) \times f_{2000}$		0.30	0.41	0.19			
		(0.29)	(0.41)	(0.37)			
$ln(1+fdi) \times bord_1 \times f_{1993}$					1.10[c]	1.68	0.53
					(0.65)	(1.29)	(0.71)
$ln(1+fdi) \times bord_1 \times f_{1994}$					0.98[b]	1.37[c]	0.59
					(0.40)	(0.76)	(0.42)
$ln(1+fdi) \times bord_1 \times f_{1995}$					0.47[c]	0.97[b]	-0.04
					(0.28)	(0.39)	(0.52)
$ln(1+fdi) \times bord_1 \times f_{1996}$					0.20	0.59[a]	-0.18
					(0.23)	(0.23)	(0.45)
$ln(1+fdi) \times bord_1 \times f_{1997}$					0.24	0.52[a]	-0.04
					(0.21)	(0.19)	(0.42)
$ln(1+fdi) \times bord_1 \times f_{1998}$					0.15	0.41[b]	-0.11
					(0.20)	(0.21)	(0.36)
$ln(1+fdi) \times bord_1 \times f_{1999}$					0.14	0.35	-0.07
					(0.20)	(0.22)	(0.34)
$ln(1+fdi) \times bord_1 \times f_{2000}$					0.16	0.21	0.12
					(0.21)	(0.27)	(0.29)
$ln(1+fdi) \times (1-bord_1) \times f_{1993}$					1.88[b]	2.96	0.81
					(0.93)	(1.86)	(0.86)
$ln(1+fdi) \times (1-bord_1) \times f_{1994}$					1.55[b]	2.18	0.92
					(0.70)	(1.34)	(0.70)
$ln(1+fdi) \times (1-bord_1) \times f_{1995}$					0.66[c]	1.12[c]	0.20
					(0.35)	(0.61)	(0.40)
$ln(1+fdi) \times (1-bord_1) \times f_{1996}$					0.48[c]	0.81[b]	0.15
					(0.26)	(0.41)	(0.32)
$ln(1+fdi) \times (1-bord_1) \times f_{1997}$					0.53[b]	0.61[c]	0.44
					(0.25)	(0.36)	(0.33)
$ln(1+fdi) \times (1-bord_1) \times f_{1998}$					0.44	0.58	0.31
					(0.27)	(0.40)	(0.35)
$ln(1+fdi) \times (1-bord_1) \times f_{1999}$					0.41	0.53	0.30
					(0.34)	(0.47)	(0.44)
$ln(1+fdi) \times (1-bord_1) \times f_{2000}$					0.34	0.46	0.22
					(0.33)	(0.46)	(0.43)
N	7520	7520	3760	3760	7520	3760	3760
R^2	0.857	0.827	0.793	0.905	0.830	0.808	0.903
RMSE	0.559	0.615	0.647	0.521	0.610	0.623	0.527

Note: Heteroskedasticity-robust standard errors in brackets, with [a], [b] and [c] denoting significance at the 1%, 5% and 10% levels, respectively.

Table 6: Time changes in the average trade-expanding impact of FDI in core regions

	Dependent Variable: log flow		
Model :	(P4)	(X4)	(M4)
$ln(dist)$	-0.45^a	-0.23	-0.66^a
	(0.11)	(0.19)	(0.14)
$bord_2$	0.23^a	0.16^b	0.31^a
	(0.04)	(0.06)	(0.05)
$bord_1$	0.24^c	-0.05	0.54^a
	(0.13)	(0.22)	(0.17)
$ln(1 + fdi) \times core \times f_{1993}$	2.30^c	2.88	1.71
	(1.40)	(2.53)	(1.61)
$ln(1 + fdi) \times core \times f_{1994}$	1.14^a	1.39^c	0.90^c
	(0.44)	(0.75)	(0.52)
$ln(1 + fdi) \times core \times f_{1995}$	0.76^a	0.98^b	0.55
	(0.28)	(0.47)	(0.34)
$ln(1 + fdi) \times core \times f_{1996}$	0.61^a	0.80^b	0.42
	(0.23)	(0.35)	(0.28)
$ln(1 + fdi) \times core \times f_{1997}$	0.58^a	0.71^b	0.45
	(0.22)	(0.33)	(0.29)
$ln(1 + fdi) \times core \times f_{1998}$	0.51^b	0.68^b	0.35
	(0.21)	(0.32)	(0.27)
$ln(1 + fdi) \times core \times f_{1999}$	0.46^b	0.61^b	0.32
	(0.19)	(0.30)	(0.25)
$ln(1 + fdi) \times core \times f_{2000}$	0.40^b	0.54^c	0.26
	(0.19)	(0.30)	(0.24)
$ln(1 + fdi) \times (1 - core) \times f_{1993}$	1.70	2.96	0.44
	(1.18)	(2.21)	(1.27)
$ln(1 + fdi) \times (1 - core) \times f_{1994}$	1.41	2.38	0.45
	(0.92)	(1.78)	(0.95)
$ln(1 + fdi) \times (1 - core) \times f_{1995}$	0.52	1.19	-0.15
	(0.58)	(0.99)	(0.70)
$ln(1 + fdi) \times (1 - core) \times f_{1996}$	0.36	0.87	-0.15
	(0.43)	(0.71)	(0.53)
$ln(1 + fdi) \times (1 - core) \times f_{1997}$	0.39	0.67	0.11
	(0.40)	(0.64)	(0.48)
$ln(1 + fdi) \times (1 - core) \times f_{1998}$	0.28	0.62	-0.05
	(0.44)	(0.71)	(0.54)
$ln(1 + fdi) \times (1 - core) \times f_{1999}$	0.18	0.53	-0.17
	(0.57)	(0.91)	(0.71)
$ln(1 + fdi) \times (1 - core) \times f_{2000}$	0.11	0.56	-0.33
	(0.62)	(0.99)	(0.81)
N	7520	3760	3760
R^2	0.832	0.792	0.899
RMSE	0.606	0.649	0.538

Note: Heteroskedasticity-robust standard errors in brackets, with ^{a}, ^{b} and ^{c} denoting significance at the 1%, 5% and 10% levels, respectively.

Because interior regions were initially less attractive than border regions, the decline experienced in the gains arising from attracting new affiliates could be less pronounced for the former than for the latter.

As can be seen in Table 6, even though core border regions experience a similar fall in FDI trade-expanding gains throughout the period, the erosion is also less dramatic there and, most importantly, the trade outperformance remains highly significant at the end of the period. A plausible explanation for the drastic fall in trade outperformances suffered by the French border regions located at the periphery of Europe would be that, during the period 1978-2000, they did not benefit from any major cross-border transport developments, whereas their communications with the north of France (in the form of new highways and railroad infrastructure) improved notably. Hence, the trade orientation of these regions shifted from their neighboring countries (Spain and Italy) towards the French northern market that was becoming more accessible overtime.

5 Conclusion

In this paper we have used an augmented gravity model to explain the geography of trade within France, over the period 1978-2000. Firstly, we have compared the trade performances of 94 regions according to their geographic position "vis-à-vis" a bloc of five neighboring countries of France, during their ongoing process of integration within Europe. We find that the regions sharing a frontier with a country trade on average as much as 70% more with this partner than other regions, once controlled for the own region-specific and country-specific characteristics. As European integration progressed, the French border regions located at the vicinity of the EU core succeeded in triggering new trade surpluses, whereas those located at the western periphery of Europe did not. Even though temporary gains were drawn from integration shocks such as the Single European Act, the Schengen Agreement and the Maastricht Treaty, they were not sufficient to counteract the drastic long-term decline suffered by the southern French regions bordering Spain and Italy.

Secondly, we have assessed how much of the observed trade differentials can be explained by the location strategy of foreign affiliates from the five countries studied. The spatial distribution of inward FDI across French regions, as its post-integration changes, explain partly these differentials. We find that inward FDI is on average trade-expanding, independently of both the country source and the geographic position of regions. Recalling that trade and outsourcing are complements whereas horizontal FDI is clearly a substitute for trade, this could be evidence that FDI from French bordering countries are mostly vertically motivated. The magnitude of the induced overtrade is larger for border regions than for their interior counterparts. However, the marginal effect of FDI is stronger for interior than for border regions, except those located at the vicinity of the EU core (*e.g.* at the north-eastern frontier of Belgium-Luxembourg and Germany), which benefit from the over-representation of foreign affiliates from all country sources. Over time the trade creating effect of inward FDI decreases. This may indicate an increasing orientation of foreign firms towards the French market, and this trend is even more pronounced for the Spanish and Italian affiliates.

However, inward FDI is not the only channel at work. Even once controlled for the possible over-representation of foreign affiliates, border regions still outperform interior regions. Although it is largely beyond the scope of this paper to properly investigate the determinants of remaining trade differentials, simple conjectures can provide useful insights. A plausible explanation would be that a dyadic variable distinct from inward FDI, also possibly sensitive to "proximity", might be specifically trade-expanding for border regions. If a first candidate is obviously outward FDI, the most plausible candidate is migrations. As shown by a couple of empirical studies, such as Wagner et al. (2002) or Combes et al. (2005), the preferences of immigrants might be biased towards the home country, and their presence in a recipient region might convey better information on the trade partner country. If border regions benefit from the over-representation of immigrants from nearby countries, due to labor/capital complementarity (as suggested for instance by Buch et al., 2006 for German FDI), or because of cultural, language and spatial proximity, which allow them to integrate more easily while keeping active linkages with their family, this could generate trade over-expansion with the home country. However, time-series data on immigration regional stocks by country source are missing and this conjecture cannot be tested properly.

In practice, the results provided in our paper may orient the new cross-border cohesion policy action for 2007-2013. Although European regional policies are designed to compensate for possible post-integration inequalities, the losses suffered at the periphery of *western* Europe seem to have been concealed by academic research at the benefit of eastward enlargement prospects. Policy initiatives such as the summit of the French and Spanish governments in Zaragoza (December 2004), which has oriented both countries' agenda towards new cross-border infrastructure developments, would have warranted more support in that respect.

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Appendix A: French data sources

Trade

Each year since 1978, French decentralized customs services record the trade flows exchanged between the 94 French NUTS3 regions and the different countries in the world for France. Regarding exports, the origins of trade flows are the regions where shipments are produced and loaded before handling to destination countries, which themselves correspond to the locations where commodities are consumed, and conversely for import flows. The measure of trade flows obtained is therefore exclusive of transit shipments (accounting therefore for more than 50% of the total exchanges between regions and countries).[21]

The data set include trade flows (in euro values) and is originally available at a highly detailed industry level (176 industries) and for five transport modes (air, maritime, rivers, railroad and road).[22]

[21] Data on French intra-national trade flows also exist. Unfortunately, their collection is not immune to transit and break-loading issues, so we cannot simply add them to customs data in order to obtain a global picture of both the intra- and international trade patterns.

[22] We neglect postal, pippers and other too specific shipments.

However, due to a change in European legislation in 1993 ruling that the mode used to transport commodities need only be recorded when crossing European borders and not national ones, the breakdown by mode is not homogenous over the whole period of study. Therefore, we work on trade aggregated over all the transport modes. Moreover, since the number of observations was low for some industries, we also aggregate trade over industries, which leads us to focus on trade values (instead of volumes) due to the standard problem of the units of measure.

Inward FDI

With respect to FDI, we use the data collected by the French Government Agency for International Investment (AFII).[23] This agency reports yearly inward bilateral regional flows originating from 47 different countries in the world, for twenty broad categories of industries.[24] Moreover, five different measures of FDI are available: The number of affiliates from parent firms, their employment scale (number of jobs created, of jobs maintained and total employment), and the investment value (millions euro). The data sample for the period 1993-2000 amounts to 3900 bilateral observations.

To avoid any distortive pattern arising from the tremendous proportion of headquarters in the capital region, we keep the flows related to three types of investments only: "Production/Assembly", "Retail/Logistics" and "Sales offices". Once aggregated over industries, our sample reduces to 1823 bilateral observations. Finally, the flows are cumulated up to the year observed in order to obtain the related stocks of regional FDI.[25]

Distance

Our distance variable corresponds to the great-circle distance between the capitals of region i and country J.

Appendix B: Location and definition of border regions

Figure 5 depicts the French NUTS2 and NUTS3 divisions and helps to locate the border regions we mention throughout the paper.

First-order border regions: contiguity criterion ($bord_1$ "All contiguous")

The easiest way to define border regions is to consider those French regions that are contiguous (by land or by sea) to their trade partner countries. This broad definition entails the following list of NUTS3 regions:

French NUTS3 bordering Belgium-Luxembourg: Nord, Aisne, Ardennes, Meuse, Meurthe et Moselle, Moselle.

French NUTS3 bordering Germany: Moselle, Bas-Rhin, Haut-Rhin.

French NUTS3 bordering United-Kingdom (opened to the English Channel): Nord, Pas-de-Calais, Somme, Seine Maritime, Eure, Calvados, Manche, îlle-et-Vilaine, Côtes-d'Armor and Finistère.

French NUTS3 bordering Spain: Pyrénées Atlantiques, Hautes-Pyrénées, Haute-Garonne, Ariège, Pyrénées Orientales.

[23] See http://www.afii.fr/France/.

[24] Among which electronics, chemicals, automobile construction and food industries are the most represented.

[25] These could mis-approximate real FDI stocks in the case when parent firms close their affiliates meanwhile. However, due to standard disclosure issues, we cannot control for this bias.

Figure 5: French NUTS2 and NUTS3 regions

French NUTS3 bordering Italy: Haute-Savoie, Savoie, Hautes-Alpes, Alpes-de-Haute-Provence, Alpes Maritimes.

First-order border regions: gateway criterion ($bord_1$ *"Transport corridors")*

We define as transport corridors those border regions that can be reached easily despite natural barriers (mountains and seas), i.e. the NUTS3 regions hosting major cross border transport infrastructures, such as highways, tunnels or industrial harbors, at the beginning of our period of study (1978). This definition leads to the following list of NUTS3 border regions:

French NUTS3 bordering Spain: Pyrénées Atlantiques (Road pass of Biriatou, highway since 1975), Pyrénées Orientales (Road pass of Le Perthus, highway since 1978).

French NUTS3 bordering Italy: Haute-Savoie (Tunnel of Mont-Blanc since 1965), Savoie (Tunnels of Frejus (road and railroad) and Mont-Cenis (railroad since 1870s), Hautes-Alpes (Road pass of Montgenèvre since 1850), Alpes Maritimes (Road pass of Tende since 1882, highway and Tunnel of Vintimille since 1980).

French NUTS3 bordering United Kingdom: Pas-de-Calais (Calais harbor), Nord (Dunkerque harbor), Seine-Maritime (Havre and Rouen harbors).

Regions bordering the EU core ($core$ *dummy)*

All NUTS3 bordering Belgium-Luxembourg and Germany: Nord, Aisne, Ardennes, Meuse, Meurthe et Moselle, Moselle, Bas-Rhin, Haut-Rhin.